

REMARKS:

- 1) The Notice of References Cited (Form PTO-892) enclosed with the Office Action does not cite US Patent 3,887,147 (Grieb) that is applied in several prior art rejections at pages 6 to 8 of the Office Action. Please list US Patent 3,887,147 (Grieb) as a cited reference on an additional Form PTO-892.
- 2) In accordance with the PCT procedures, the original specification of this application was a direct literal translation of the corresponding foreign language text of the counterpart PCT international application. The translated specification has now been editorially and formally amended (e.g. to include section headings, avoid reference to particular claim numbers in the description, etc.). These amendments are merely editorial and formal in nature and do not introduce any new matter. Entry thereof is respectfully requested.
- 3) Further according to the PCT procedures, the original claims of this application were based on a direct literal translation of the foreign language claims of the PCT international application. The claims have now been editorially and formally amended to better comport with US claim style and format. The consistency and streamlining of terminology has been improved. Also, independent claims 17 and 25 have been substantively amended to more clearly distinguish the invention over the prior art, as will be discussed below. It has been made clear that the

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mechanical operator element is linearly slidably arranged between the rotor of the first turbine and the sensor element, and is located adjacent to the rotor such that the rotor will strike the operator element and linearly slide the operator element with a linear sliding motion toward the sensor element in the event of a shaft break of the rotor shaft. The sensor element is arranged and adapted to convert the linear sliding motion of the operator element into an electrical signal. These features are supported by the original disclosure, for example at page 3 lines 11 to 22, and page 6 line 23 to page 9 line 25. New dependent claims 33 and 34 have been added based on optional features that were deleted from claims 17 and 25. New independent claim 35 has been drafted "from the ground up" as a fresh approach at covering inventive subject matter, with a slightly different format, style and terminology in comparison to the original translated PCT claims. New claim 35 is based on original claims 17 and 25, as well as the portions of the specification cited above. New dependent claims 36 and 37 depend from claim 35 and are based on subject matter from prior claims 17, 20 and 21. In view of the above indicated original support, the claim amendments and the new claims do not introduce any new matter. Entry and consideration thereof are respectfully requested.

- 4) Referring to pages 2 and 3 of the Office Action, the rejection of claims 17 to 32 as indefinite under 35 USC 112(2) has been addressed in the amendment of claims 17 and 25. The optional features have been deleted and instead recited in new dependent claims 33 and 34 as positive additional limitations. Thus, the

claims now avoid any ambiguity. Please withdraw the rejection under 35 USC 112(2).

- 5) Referring to pages 3 and 4 of the Office Action, the rejection of claims 17 to 19, 21 and 22 as anticipated by US Patent 1,326,867 (Junggren) is respectfully traversed.

Currently amended independent claim 17 is directed to an arrangement for detecting a shaft break on a rotor of a first turbine in a gas turbine machine. The arrangement includes a mechanical operator element positioned between the first turbine rotor and a stator of a second turbine, as well as a sensor element guided in the second turbine stator. The mechanical operator element is linearly slidably arranged between the first turbine rotor and the sensor element such that the rotor will strike the operator element and linearly slide the operator element toward the sensor element in the event of a shaft break of the rotor shaft. The sensor element is arranged and adapted to convert the linear sliding motion of the operator element into an electrical signal. This combination of a linearly slidable mechanical operator element interacting with a sensor element that converts the mechanical actuation of the operator element into an electrical signal achieves a very robust, reliable, and easily serviceable arrangement (as explained in the present specification, e.g. at page 2 line 21 to page 4 line 17). The prior art reference does not disclose and would not have suggested such an arrangement.

Junggren discloses a steam turbine as an elastic fluid turbine, which includes an electric contact device at locations

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in the turbine at which a certain clearance space must be maintained. The electric contact device includes a metal cap 18 that slips over the end of an insulated wire 19, of which the insulation has been cut back to leave an exposed wire end 20 resting against a piece of insulation 21 in the bottom of the metal cap 18 (page 1 line 100 to page 2 line 12). This forms the electrical contact device 25 that is mounted in the stator 15 adjacent to a clearance gap spaced from the rotor 17. If the rotor 17 deviates from its proper position, it will contact against the contact device 25 and thereby wear off the end of the cap 18 and create an electrical contact of the rotor 17 onto the conductor 22 of the wire 19 (page 2 lines 35 to 50). This causes an electrical circuit to be completed through the conductor wire 22 and the rotor 17 to ground 28. The closed electrical circuit causes a signal that may activate a signal bell 41 to indicate damage of the turbine such as buckling or deflection of certain parts, a wheel loosening on the shaft, or a bucket cover coming loose (page 1 lines 16 to 22), so that the turbine may be shut down.

The arrangement of Junggren does not include a mechanical operator element that is linearly slidably arranged between the first turbine rotor and a sensor element. Junggren does not include any such linearly slidable mechanical operator. Instead, the sensor element itself is designed to make a direct electrical contact with the rotor. Furthermore, the sensor element is not arranged and adapted to convert a linear sliding motion of an operator element into an electrical signal. Instead, the sensor element itself completes an electrical circuit by directly

contacting the rotor, which becomes a part of the electrical circuit. The sensor element is not triggered by a linearly sliding mechanical operator element. Therefore, claim 17 is not anticipated.

The dependent claims are patentably distinguishable over the prior art already due to their dependence.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 17 to 19, 21 and 22 as anticipated by Junggren.

- 6) Referring to pages 4 and 5 of the Office Action, the rejection of claims 20 and 23 as obvious over Junggren in view of US Patent 4,498,291 (Jeffery) is respectfully traversed. Claims 20 and 23 depend from claim 17, which has been discussed above in comparison to Junggren. The Examiner has additionally applied Jeffery for disclosing the use of a shear pin 132 holding an operative element 90, thereby preventing accidental triggering or assuring triggering of the device only when the shaft breaks, according to the Examiner. While Jeffery discloses the use of shear pins 132, those shear pins have nothing to do with holding a linearly slidable mechanical operator element that acts upon and cooperates with an electromechanical sensor element. Instead, in the Jeffery arrangement, the shear pins 132 actually mount the nozzle guide vane segments 26. These shear pins are designed to break when the vane mount structure is struck by the overspeeding rotor 14 after a shaft break. Thereby, when the shear pins 132 break, they actually release the stator vanes 26, to allow them to break free. That would not have suggested

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providing a shear pin to hold a linearly slidable mechanical operator element, so as to fix it in the axial direction and prevent unintentional axial sliding thereof until an overspeeding rotor actually strikes the operator element and slides it in the axial direction to activate a sensor element. Instead, a combined consideration of Jeffery with Junggren would merely have suggested to hold the stator vanes 15 of the Junggren turbine by means of shear pins that allow the stator vanes to break away if the rotor 17 of Junggren strikes against the mount of the stator 15 of Junggren. That would not have suggested the present invention. For these reasons, the Examiner is respectfully requested to withdraw the rejection of claims 20 and 23 as obvious over Junggren in view of Jeffery.

- 7) Referring to pages 5 and 6 of the Office Action, the rejection of claim 24 as obvious over Junggren in view of US Patent 6,607,349 (Mulera et al.) is respectfully traversed. Claim 24 depends from claim 17, which has been discussed above in comparison to Junggren. Furthermore, claim 24 specifies that the sensor element is an impact sensor. The Examiner has acknowledged that Junggren does not disclose an impact sensor, but has cited Mulera et al. in this regard. While Mulera et al. disclose the use of an impact sensor for shutting down a gas turbine engine, this impact sensor arrangement is located differently than in the present invention. Namely, according to the present invention, an impact sensor element is arranged and guided in the stator of a second turbine, while a mechanical operator element is positioned between the rotor of a first

turbine and the stator of the second turbine. To the contrary, according to Mulera et al., the impact sensor or detector assembly 22 including the impact sensor link 24 is mounted to the rear engine bearing holder behind the third (last) stage power turbine wheel (col. 4 lines 40 to 55). That arrangement would not have suggested any way of arranging an impact sensor between successive turbine stages, and particularly would not have suggested the inventive arrangement in which the impact sensor element is arranged and guided in the stator of a second turbine, so that the sensor element may be easily radially removed out of the engine for maintenance or replacement purposes (for example see page 3 line 22 to page 4 line 7 of the present specification). For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claim 24 as obvious over Junggren in view of Mulera et al.

- 8) Referring to pages 6 and 7 of the Office Action, the rejection of claims 25 to 27, 29 and 30 as obvious over US Patent 3,887,147 (Grieb) in view of Junggren is respectfully traversed.

Independent claim 25 is directed to a gas turbine that includes an arrangement for detecting a shaft break of a first turbine rotor essentially according to claim 17 which has been discussed above in comparison to Junggren. Namely, claim 25 recites the same distinguishing features that have been discussed above regarding claim 17 in comparison to Junggren. Thus the above discussion is incorporated here by reference.

The Examiner has applied Grieb for disclosing basically only a three spool aircraft engine design with three turbine stages.

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The Examiner has acknowledged that Grieb does not disclose an arrangement for detecting a shaft break, and has applied Junggren in this regard. Therefore, the above discussion of Junggren applies here in the context of claim 25 as well. As discussed in further detail above, Junggren does not disclose and would not have suggested the arrangement of a linearly slidable mechanical operator cooperating with an electromechanical sensor element, whereby the sensor element is guidedly arranged in a second turbine stator while the mechanical operator element is linearly slidably arranged between the first turbine rotor and the second turbine stator. Instead, the arrangement of Junggren simply includes an electrical sensor in the form of an end of an electrical conductor wire that electrically contacts the rotor and forms a circuit through the wire and the rotor to ground in the event of a loose rotor bucket or the like. That would not have suggested the presently claimed invention, for the reasons discussed above.

The dependent claims are patentably distinguishable over the prior art already due to their dependence.

For these reasons, the Examiner is respectfully requested to withdraw the rejection of claims 25 to 27, 29 and 30 as obvious over Grieb in view of Junggren.

- 9) Referring to pages 7 and 8 of the Office Action, the rejection of claims 28 and 31 as obvious over Grieb in view of Junggren and further in view of Jeffery is respectfully traversed. The above discussion of Jeffery relating to claims 20 and 23 applies here in the context of claims 28 and 31. Namely, the use of shear



pins according to Jeffery would not have been relevant and would not have suggested the presently claimed very different use of a shear pin, even if the teachings of Jeffery would have been considered together with those of Grieb and Junggren. Instead, the result simply would have been using shear pins to mount stator vanes in the turbine of Grieb with the electrical wire contact sensor of Junggren. That would not have suggested the present invention. The Examiner is respectfully requested to withdraw the rejection of claims 28 and 31 as obvious over Grieb in view of Junggren and Jeffery.

- 10) Referring to page 8 of the Office Action, the rejection of claim 32 as obvious over Grieb in view of Junggren and further in view of Mulera et al. is respectfully traversed. The above discussion of Mulera et al. in comparison to claim 24 applies here as well in the context of claim 32. Namely, even the combined consideration of Grieb and Junggren with Mulera et al. would not have suggested the presently claimed arrangement of an impact sensor element guided in the stator of a second turbine while a linearly slidable mechanical operator element is arranged between the rotor of a first turbine and the sensor element in the stator of a second turbine. For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claim 32 as obvious over Grieb in view of Junggren and Mulera et al.

- 11) Referring to the top of page 9 of the Office Action, the additional prior art made of record requires no particular comments because it has not been applied against the claims.

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- 12) New claims 35 to 37 also patentably distinguish the invention over the prior art. Claim 35 is directed to a gas turbine machine comprising a first turbine including a first turbine rotor connected to a rotor shaft, a second turbine including a second turbine stator arranged downstream from the first turbine rotor, a mechanical operator element linearly slidably mounted to the second turbine stator, and an electromechanical sensor element also mounted to the second turbine stator. This arrangement and location of a mechanical operator element cooperating with an electromechanical sensor element would not have been suggested by a combination of all of the references as discussed above. The dependent claims 36 and 37 recite additional features that further distinguish the invention from the prior art, which the Examiner is respectfully requested to consider.
- 13) Favorable reconsideration and allowance of the application, including all present claims 17 to 37, are respectfully requested.

Respectfully submitted,

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Enclosures:  
Transmittal Cover Sheet  
Term Extension Request  
Form PTO-2038

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CERTIFICATE OF FAX TRANSMISSION:

I hereby certify that this correspondence with all indicated enclosures is being transmitted by telefax to (571) 273-8300 on the date indicated below, and is addressed to: COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450.

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